

1 **CLAIMS**

2 1. A method for coding video data according to layered coding
3 techniques in which the video data is represented as multi-layered frames, each
4 frame having multiple layers ranging from a base layer of low quality to
5 enhancement layers of increasingly higher quality, the method comprising:

6 forming a base layer for frames in the video data; and

7 forming multiple enhancement layers for the frames by (1) predicting even
8 frames from even enhancement layers, but not odd enhancement layers, of
9 preceding odd frames and (2) predicting odd frames from odd enhancement layers,
10 but not even enhancement layers, of preceding even frames.

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12 2. A method as recited in claim 1, further comprising storing the base
13 layer and the enhancement layers in memory.

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15 3. A method as recited in claim 1, further comprising:
16 transmitting the base layer over a network; and
17 transmitting one or more of the enhancement layers over the network
18 according to bandwidth availability on the network.

19
20 4. A method as recited in claim 1, further comprising recovering the
21 video data from the base layer and any enhancement layer.

1 5. A method as recited in claim 4, further comprising reconstructing a
2 missing enhancement layer from an enhancement layer of a reference
3 reconstructed frame.

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5 6. A computer-readable medium having computer-executable
6 instructions, which when executed on a processor, direct a computer to perform
7 the steps of claim 1.

8
9 7. A method for coding video data according to layered coding
10 techniques in which the video data is represented as multi-layered frames, each
11 frame having multiple layers ranging from a base layer of low quality to
12 enhancement layers of increasingly higher quality, the method comprising:

13 forming a base layer for frames in the video data; and

14 forming at least first, second, and third enhancement layers by (1)
15 predicting even frames from the base layer and the second enhancement layer, but
16 not the first enhancement layer or the third enhancement layer, of preceding odd
17 frames and (2) predicting odd frames from the base layer and the third
18 enhancement layer, but not the second enhancement layer, of preceding even
19 frames.

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21 8. A method as recited in claim 7, further comprising storing the base
22 layer and the enhancement layers in memory.

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24 9. A method as recited in claim 7, further comprising:

25 transmitting the base layer over a network; and

1 transmitting one or more of the enhancement layers over the network
2 according to bandwidth availability on the network.
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4 **10.** A method as recited in claim 7, further comprising recovering the
5 video data from the base layer and any enhancement layer.
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7 **11.** A method as recited in claim 10, further comprising reconstructing a
8 missing enhancement layer from an enhancement layer of a reference
9 reconstructed frame.
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11 **12.** A computer-readable medium having computer-executable
12 instructions, which when executed on a processor, direct a computer to perform
13 the steps of claim 7.
14

15 **13.** A method for coding video data, comprising:
16 encoding frames of the video data into a base layer of low quality; and
17 encoding the frames of the video data into multiple enhancement layers of
18 increasingly higher quality such that the enhancement layers of even frames are
19 predicted from even layers, but not odd layers, of preceding odd frames and the
20 enhancement layers of odd frames are predicted from odd layers, but not even
21 layers, of preceding even frames.
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23 **14.** A method as recited in claim 13, further comprising storing the base
24 layer and the enhancement layers in memory.
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1 **15.** A method as recited in claim 13, further comprising:
2 transmitting the base layer over a network; and
3 transmitting one or more of the enhancement layers over the network
4 according to bandwidth availability on the network.

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6 **16.** A method as recited in claim 13, further comprising decoding the
7 base layer and the one or more enhancement layers into the video data.

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9 **17.** A method as recited in claim 16, further comprising reconstructing a
10 missing enhancement layer from an enhancement layer of a reference
11 reconstructed frame.

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13 **18.** A computer-readable medium having computer-executable
14 instructions, which when executed on a processor, direct a computer to perform
15 the steps of claim 13.

16
17 **19.** A method comprising:
18 encoding video data into multi-layered frames where each frame has a base
19 layer of low quality to enhancement layers of increasingly higher quality and
20 selected enhancement layers in a current frame are predicted from at least one
21 lower quality layer in a reference frame that is not the base layer; and
22 transmitting the base layer and one or more of the enhancement layers over
23 a network.

1 **20.** A method as recited in claim 19, wherein the encoding comprises
2 predicting each enhancement layer in the current frame using all of the lower
3 quality layers in the reference frame.

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5 **21.** A method as recited in claim 19, wherein the encoding comprises
6 predicting even frames from even layers of preceding odd frames and predicting
7 odd frames from odd layers of preceding even frames.

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9 **22.** A method comprising:
10 encoding video data into multi-layered frames where each frame has a base
11 layer of low quality to enhancement layers of increasingly higher quality, the
12 enhancement layers including at least first, second, and third layers, and the
13 encoding comprises predicting even frames from the base and second layers of
14 preceding odd frames and predicting odd frames from the base and third layers of
15 preceding even frames; and
16 transmitting the base layer and one or more of the enhancement layers over
17 a network.

18
19 **23.** A method as recited in claim 22, further comprising:
20 receiving the base layer and the one or more enhancement layers from the
21 network; and
22 decoding the base layer and the one or more enhancement layers to recover
23 the video data.
24
25

1 **24.** A method as recited in claim 22, further comprising reconstructing a
2 missing enhancement layer from an enhancement layer of a reference
3 reconstructed frame.

4
5 **25.** A computer-readable medium having computer-executable
6 instructions, which when executed on a processor, direct a computer to:

7 construct a base layer for frames in the video data; and

8 construct multiple enhancement layers for the frames in the video data by
9 predicting even frames from even layers, and not odd layers, of preceding odd
10 frames and predicting odd frames from odd layers, and not even layers, of
11 preceding even frames.

12
13 **26.** A computer-readable medium as recited in claim 25, further having
14 instructions that direct a computer to store the base layer and the enhancement
15 layers in memory.

16
17 **27.** A computer-readable medium as recited in claim 25, further having
18 instructions that direct a computer to:

19 transmit the base layer over a network; and

20 transmit one or more of the enhancement layers over the network according
21 to bandwidth availability on the network.

1 **28.** A computer-readable medium as recited in claim 25, further having
2 instructions that direct a computer to recover the video data from the base layer
3 and any of the enhancement layers.

4
5 **29.** A computer-readable medium as recited in claim 28, further having
6 instructions that direct a computer to reconstruct a missing enhancement layer
7 from an enhancement layer of a reference reconstructed frame.

8
9 **30.** A computer-readable medium having computer-executable
10 instructions, which when executed on a processor, direct a computer to:

11 construct a base layer for frames in the video data; and
12 construct multiple enhancement layers for the frames in the video data,
13 where the enhancement layers include at least first, second, and third layers of
14 increasingly higher quality video data than the base layer, by predicting even
15 frames from the base and second layers of preceding odd frames and predicting
16 odd frames from the base and third layers of preceding even frames.

17
18 **31.** A computer-readable medium as recited in claim 30, further having
19 instructions that direct a computer to store the base layer and the enhancement
20 layers in memory.

21
22 **32.** A computer-readable medium as recited in claim 30, further having
23 instructions that direct a computer to:

24 transmit the base layer over a network; and
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1 transmit one or more of the enhancement layers over the network according
2 to bandwidth availability on the network.

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4 **33.** A computer-readable medium as recited in claim 30, further having
5 instructions that direct a computer to recover the video data from the base layer
6 and any of the enhancement layers.

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8 **34.** A computer-readable medium as recited in claim 33, further having
9 instructions that direct a computer to reconstruct a missing enhancement layer
10 from an enhancement layer of a reference reconstructed frame.

11
12 **35.** A video coding system comprising:
13 a base layer encoder to encode frames of video data into a base layer;
14 an enhancement layer encoder to encode the frames into multiple
15 enhancement layers of higher quality than the base layer; and
16 wherein the enhancement layer encoder predicts even frames from even
17 layers, and not odd layers, of preceding odd frames and predicts odd frames from
18 odd layers, and not even layers, of preceding even frames.

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20 **36.** A video coding system, comprising:
21 a base layer encoder to encode frames of video data into a base layer;
22 an enhancement layer encoder to encode the frames into multiple
23 enhancement layers of higher quality than the base layer, the multiple
24 enhancement layers including at least first, second, and third layers; and
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1 wherein the enhancement layer encoder predicts even frames from the base
2 and second layers of preceding odd frames and predicts odd frames from the base
3 and third layers of preceding even frames.
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